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U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 262.

Experiment Station Work,

XXXVI.

Compiled from the Publications of the Agricultural Experiment Stations.

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GLUTENOUS AND STARCHY WHEATS.
DRY FARMING.
METHODS OF CANNING.
BEET MOLASSES AND PULP.
FEED LOTS.
GUINEA FOWLS.
COLOR OF EGGS.
SPRAYING FOR SCALE INSECTS.
WHITE PINE IN NEW ENGLAND.

PREPARED IN THE OFFICE OF EXPERIMENT STATIONS.

A. C. TRUE, Director.

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THE AGRICULTURAL EXPERIMENT STATIONS.

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EXPERIMENT STATION WORK.

Edited by W. H. BEAL and the Staff of the Experiment Station Record.

Experiment Station Work is a subseries of brief popular bulletins compiled from the published reports of the agricultural experiment stations and kindred institutions in this and other countries. The chief object of these publications is to disseminate throughout the country information regarding experiments at the different experiment stations, and thus to acquaint farmers in a general way with the progress of agricultural investigation on its practical side. The results herein reported should for the most part be regarded as tentative and suggestive rather than conclusive. Further experiments may modify them, and experience alone can show how far they will be useful in actual practice. The work of the stations must not be depended upon to produce "rules for farming." How to apply the results of experiments to his own conditions will ever remain the problem of the individual farmer.—A. C. TRUE, Director, Office of Experiment Stations.

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EXPERIMENT STATION WORK.[a]

WATER FOR TABLE USE.[b]

It would hardly seem necessary to direct the attention of anyone to the desirability of pure water, clean water coolers, pitchers, water bottles, and drinking glasses, and pure ice. Yet, to the careful observer, it is evident that many persons not only overlook the first requirements of an attractive table in these respects, but are careless of the water and ice supply to an extent which menaces the health of the household.

Water may be clear, cold, free from odor and taste, and yet be unfit for drinking purposes because of bacterial contamination from sewage or other cause. In the same way ice may look clean yet contain objectionable matter, including harmful micro-organisms.

As a part of their regular work a number of the agricultural experiment stations, including among others those of California, Connecticut (State), Idaho, Indiana, Massachusetts, New Hampshire, South Carolina, Vermont, and West Virginia, have made examinations of potable waters with a view to determining their purity and fitness for household use. In some of this work the ice supplies also are included. In some of the States such examinations are also made under the auspices of the State boards of health.

In Massachusetts the inspection of water and ice supplies has formed a very important part of the work of the State board of health for many years, and an experiment station for the study of water supply, sewage disposal, and related questions has been established and many problems relating to water supply have received extensive study.

That water may often be undesirable for drinking purposes is illustrated by studies at the Vermont Experiment Station. Of 231 samples of water from springs, wells, ponds, etc., analyzed, 22 per cent of

[a] A progress record of experimental inquiries, published without assumption of responsibility by the Department for the correctness of the facts and conclusions reported by the stations.

[b] Compiled from California Sta. Rpt. 1904, p. 34; Connecticut State Sta. Rpt. 1900, p. 201; Iowa Sta. Bul. 71; Vermont Sta. Rpt. 1898, p. 177; West Virginia Sta. Bul. 89; U. S. Dept. Agr., Bur. Chem. Bul. 91; Mass. State Bd. Health Rpts. 1900–1904.

the spring water, 50 per cent of the well water, and 41 per cent of the water from ponds, etc., were found to be impure, or at least of doubtful purity. Of 4 samples of pond ice examined, all were unfit for use.

A simple way of securing wholesome water for drinking purposes in the home is to boil it. Many persons object to the taste of boiled water and insist that it is flat and unpalatable. Fresh water owes its sparkle to the air dissolved in it, and the flat taste of boiled water is due to the fact that the air normally present in drinking water has been almost entirely driven out by heat. A few minutes' vigorous boiling is sufficient for ordinary safety; and if fresh water is boiled for a short time only, it retains more or less air and when properly cooled is by no means unpalatable.

Water properly distilled is free from harmful impurities and is very satisfactory for household use. Several stills, simple in construction and operation, have been devised which are suitable for use in the home. Such a still has been described in an earlier publication of this Department.[a] Several years ago the statement was quite widely circulated in popular journals that distilled water was very unwholesome, because it dissolved and removed from the tissues necessary salts. So far as can be learned, there was no experimental evidence for such a statement, nor is this belief commonly held by well-informed physiologists.

Boiled, distilled, or other water which is perfectly satisfactory for drinking purposes is frequently contaminated by adding dirty ice or by keeping it in a water cooler which has not received proper attention. If there is any doubt as to the ice supply it certainly seems the part of common sense to cool the water in receptacles placed near the ice, or in some other way so that it is out of actual contact with the ice. Under favorable conditions the process of freezing is undoubtedly a process of purification, but it may be safely assumed that under ordinary conditions contaminated water will produce an impure and unsafe ice. Moreover, ice is generally handled in a manner which is not conducive to cleanliness. Obviously such ice should not come in contact with food or drink. Its beneficial effects can be obtained without actual contact, and contact means contamination.

The sale of simple potable waters for table use has greatly increased within recent years, owing to the fact that many persons distrust the ordinary water supply and believe that by purchasing water in bottles or jugs they are sure of obtaining something which is entirely satisfactory.

The Connecticut State Experiment Station recently examined a considerable number of samples of such waters and found that although the majority of them were of good quality a number were not above

[a] U. S. Dept. Agr., Farmers' Bul. 124, p. 5.

suspicion. It must be remembered that water from an uncontaminated source may become unwholesome if it is carelessly bottled or marketed in unclean receptacles.

The Bureau of Chemistry of this Department has reported[a] an extended series of investigations which have to do with the mineral waters of the United States, most of them being those which are sold in bottles and more or less extensively used, some for medicinal purposes and others, particularly those containing only a small amount of mineral matter, as table waters. These investigations showed that in many cases when such waters reach the consumer a bottle may not contain the water indicated by the label, owing either to incorrect labeling in the first place or to tampering with the contents of the bottles by the dealer.

Very many persons who are very careful to secure pure water for their tables do not exercise the same precautions with the water used in their kitchens for washing vegetables, etc., and lettuce and other foods which are eaten raw may appear on the table after being washed in water which would not be considered fit to drink.

A good illustration of the need of pure water for household purposes is afforded by experiments at the Iowa Experiment Station on the keeping quality of butter washed with pasteurized and unpasteurized water. In every case the butter washed with the sterile water kept better than the other.

The dangers from wells and other water supplies, the precautions which should be taken to insure pure water, and other related questions have been discussed with reference to the importance of pure water on farms in earlier bulletins of this Department.[b]

FERTILIZING VALUE OF DIFFERENT PHOSPHATES.[c]

A previous bulletin of this series[d] contained an article on this subject in which the following statement was made:

> The different phosphates used in fertilizers differ widely in availability, i. e., in the readiness with which they are taken up by plants, and different plants have been found to vary greatly in their capacity to assimilate the phosphoric acid of a given phosphate. The insoluble phosphates are much cheaper than the soluble forms. Phosphoric acid in soluble form costs in the market from 4 to 6 cents per pound (often more in mixed fertilizers), while that of the crude mineral phosphates is worth less than 2 cents per pound. If, therefore, it can be shown that certain plants can utilize some of the insoluble phosphates to good advantage the outlay for phosphates may be greatly reduced.

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[a] U. S. Dept. Agr., Bureau of Chemistry Bul. 91.

[b] U. S. Dept. Agr., Farmers' Buls. 43 and 73, p. 3.

[c] Compiled from Alabama College Sta. Bul. 16; Illinois Sta. Circs. 68, 87, 96, 97, 99, 101; Maryland Sta. Bul. 68; Massachusetts Sta. Rpt. 1904, p. 131; Ohio Sta. Bul. 134; Pennsylvania Sta. Rpt. 1894, p. 258; Vermont Sta. Rpt. 1888, p. 89; U. S. Dept. Agr., Office Expt. Stas. Bul. 164, p. 140; Illinois Agriculturist, 10 (1906), No. 5, p. 173.

[d] U. S. Dept. Agr., Farmers' Bul. 56.

Experiments made by the Maine Experiment Station were cited in the article containing this statement, which indicated that with certain kinds of plants, notably turnips and ruta-bagas, crude fine-ground Florida rock phosphate (floats) was utilized to good advantage at all stages of growth as a source of phosphoric acid. Other crops, such as corn, barley, clover, tomatoes, and potatoes, did not respond to applications of the insoluble phosphates in the earlier stages of growth, but utilized it to better advantage in later stages of growth, thus suggesting "that it may be profitable on certain crops grown on a large scale to combine the soluble and insoluble phosphates, applying a small amount of the former at time of planting to hasten the early growth of the crop, and a larger amount of the latter a few weeks later to supply the wants of the more advanced plants. In this way the outlay for phosphoric acid would be greatly reduced and probably the yield in no way decreased."

The fertilizing value of the insoluble phosphates, such as crude fine-ground Florida or Tennessee rock phosphate, as compared with the more soluble and readily available forms of phosphoric acid, such as acid phosphate, Thomas slag, etc., has been carefully investigated in recent years by a number of other experiment stations, particularly those of Illinois, Maryland, Massachusetts, and Ohio, and, while the results have not been entirely conclusive, they in general bear out those obtained by the Maine Station, and indicate that such phosphates may in many cases profitably replace to a large extent the more expensive phosphates, particularly on soils naturally or artificially supplied with an abundance of decaying organic matter (humus) and with certain kinds of crops, especially those having a long season of growth and with which early maturity is not an important consideration. On the other hand, crops which must be forced in their early stages of growth and brought to early maturity require more soluble forms of phosphoric acid.

Experiments made by a number of eastern experiment stations show rather conclusively that the insoluble phosphates can not be profitably used, for example, in market gardening on the light soils best adapted to that purpose, while it has been clearly demonstrated by several of the southern and western experiment stations that, when used in connection with liberal applications of stable manure or green manures, the cheap insoluble phosphates are about as effective and much more economical in general farming than the high-priced acid phosphates. The use of fine-ground phosphates or floats in connection with green manures, cotton-seed meal, and other organic matter, the decomposition of which in the soil is believed to render the phosphoric acid more available, has long been practiced in the South, and the advantages of the practice have been demonstrated by the Alabama Experiment Station.

The more recent experiments of the Ohio Station showed that when fine-ground rock phosphate (floats) was sprinkled on barnyard manure at the rate of 40 pounds per ton of manure it not only acted as a preventive of loss of nitrogen,[a] but was itself improved in availability. The floats was apparently as effective as gypsum and kainit in preventing loss of nitrogen, and at the same time reenforced the manure in a constituent (phosphoric acid) in which it is usually deficient. C. G. Hopkins shows that as an average of 42 different tests by the Ohio Station, extending over a period of seven years, "the average value of farm manure was found to be $1.99 per ton, measured in increased crop yields produced, but when 40 pounds of finely ground rock phosphate were added to the ton of manure, its average value was found to be $3.23 per ton, making an increased value, due to the addition of the phosphorus, of $1.24 per ton of manure."

The 40 pounds of rock phosphate used cost about 16 cents, thus showing a net profit of $1.08 for every ton of manure with which the phosphate was mixed.

The 16 cents' worth of raw rock phosphate produced almost as large an increase in the crop yields as 30 cents' worth of ordinary acid phosphate, the use of which gave an added net return of $1.18 for each ton of manure with which the acid phosphate was mixed. As an average of 42 tests with each material, $1 invested in raw rock phosphate made a net profit of $6.75, and $1 invested in acid phosphate made a net profit of $3.93. Furthermore, the 40 pounds of untreated rock phosphate enriches the soil in phosphorus twice as much as the 40 pounds of acid phosphate; consequently, in the long run, the untreated rock phosphate must produce the more lasting results.

In order that the manure may exert its full effect in rendering the phosphoric acid more available, the floats should be kept in contact with the manure as long as possible. This is best accomplished by sprinkling the floats over the manure as it is produced from day to day. Doctor Hopkins advises the use of 100 pounds of finely ground rock phosphate to each ton of manure.

Experiments with different phosphates at the Maryland Experiment Station, extending over a number of years and including a variety of crops—corn, wheat, hay, crimson clover, etc.—showed that the insoluble phosphates gave a greater total product for a series of years than the soluble phosphates and at about one-half the cost of the latter. The best results were obtained with the insoluble phosphates when the soil was well filled with organic matter, the most efficient of the means of effecting this tested in these experiments being the use of crimson clover as a green manure.

In a series of four-year rotations of wheat, grass (timothy and clover), corn, and oats at the Pennsylvania Experiment Station it was found that ground steamed bone (which contains phosphoric acid in

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[a] U. S. Dept. Agr., Farmers' Bul. 162, p. 1.

insoluble form) gave better results than dissolved boneblack in case of corn and that its residual effect was greater in all cases.

Doctor Hopkins has summed up the results of his own experiments at the Illinois Station with insoluble phosphates and those of the Maryland and Ohio stations as follows:

Before we had begun the general investigation of Illinois soils, Patterson had some good evidence that when turned under with crimson clover raw rock phosphate is as valuable as bone meal, and Thorne had demonstrated that when used in intimate connection with farm manure rock phosphate is much more profitable than acid phosphate on the basis of money invested. * * *

The Illinois experiments with rock phosphate, although extensive in scope, were begun too recently to afford much data. It may be stated, however, that where we have used finely ground natural rock phosphate in direct comparison with equal money values of steamed bone meal, both being applied in connection with decaying organic matter, we have thus far obtained a larger average increase with the rock phosphate.

So far as I can learn, whoever has persistently tried the use of liberal amounts of finely ground rock phosphate, in connection with abundance of decaying organic matter, has obtained results beyond his expectations. * * *

Why should we pay $80 for 4 tons of "complete fertilizer," or even $30 for 2 tons of acid phosphate, for the same amount of phosphorus as we can buy for $8 in 1 ton of finely ground natural rock phosphate? Some will answer that the raw rock is not readily available. This is true; but it is also true that it is the business of the farmer to make it available by means of decaying organic matter, the same means by which he makes available the insoluble potassium and the raw rock phosphate naturally contained in the soil.

As regards methods of using rock phosphate, Doctor Hopkins makes the following recommendations:

The phosphate may be scattered over the manure from day to day as the manure is being made in the stable or in the feed lot; indeed, this appears to be the ideal method of using it; or, when loading the manure onto the manure spreader from the yard or stall, the spreader box may be loaded half full, then 100 pounds of rock phosphate scattered over the manure as uniformly as possible, and after completing the load of manure it may be hauled to the field and spread.

If farm manure is not available, then I advise applying from 1,000 to 2,000 pounds of finely ground rock phosphate per acre every three to six years, depending upon the length of the rotation. In this case the phosphate should be applied to clover sod or to a catch crop of cowpeas, soy beans, etc., and plowed under with as much organic matter as practicable. With a three-year rotation of corn, wheat, and clover, or corn, oats, and clover, 1,000 pounds of rock phosphate may be applied to the clover sod and turned under, preferably in connection with the second crop of clover, which often is worth more to turn under than it is to cut for seed. With a six-year rotation of corn, oats, wheat, clover, timothy, and pasture, 1 ton per acre of rock phosphate may be applied to the pasture ground in connection with farm manure and plowed under for corn, preferably with a considerable growth of grass and clover.

In general, we may say that soluble phosphates like acid phosphate are more expensive than the insoluble phosphates, fine-ground Florida or Tennessee phosphate, but quicker in action and thus better suited to short-season, high-value crops which it is desirable to force to early maturity, such as are grown in market gardening. For the long-

season crops, usually grown in general farming, and for cruciferous plants, such as turnips, cabbage, etc., the insoluble phosphates may prove fully as effective and much more economical than the acid phosphates, particularly if used on soils naturally well stocked with humus, or in connection with barnyard manure or green manures. The insoluble phosphates also give better results when used on moist clay soils rather than on dry sandy soils and applied in connection with soluble fertilizing materials such as ammonium sulphate and potash salts.

WINTER WHEAT.[a]

The importance of the winter-wheat crop becomes more apparent when we consider that the annual production of the country is from 100,000,000 to 150,000,000 bushels greater than the annual yield of spring wheat, and that about 24 States and Territories grow winter wheat exclusively, while only 11 grow spring wheat, and 8 produce both crops together. Some of the advantages in growing winter wheat over raising spring wheat are a more convenient distribution of farm work; the conservation of soil fertility by the growing crop during the time the land would otherwise be bare; a better development of the crop, as it generally matures before the dry and hot weather of summer, and the production usually of heavier yields. The average yields per acre in the States growing winter wheat only are not generally as large as in the States producing spring wheat exclusively, but the better yields, as a rule, in the regions where both crops are grown are obtained from winter wheat.

A notable increase in the production of the crop has taken place in Nebraska. Fifteen years ago the proportion of winter wheat to the total wheat production of the State amounted to about 15 per cent, while at present the spring wheat produced bears about the same relation to the total annual yield. Nebraska now ranks second among the winter wheat-producing States, Kansas standing first. During the last five years the winter-wheat production of the State has been increased by about 10,000,000 bushels. In bringing about this remarkable change the State experiment station, which began its work in this line when very little winter wheat was grown in the State, has been a great factor. The dissemination of hardy strains and varieties by this institution, cooperating with the Department of Agriculture, has borne excellent results. In 1900 seed of hardy strains of Turkish Red and Big Frame wheat was distributed to 400 farmers throughout the northern and the western parts of the State for the purpose of extending the culture of the crop to new areas.

Variety tests with winter wheats, including Hungarian and Russian sorts, were conducted in cooperation with this Department from 1902

[a] Compiled from Nebraska Sta. Bul. 89.

to 1904. The first of these seasons Turkish Red, grown on the station farm for a number of years, gave the best yield, 33.2 bushels per acre, but was surpassed in quality by Theiss, a Hungarian variety, and by several of the Russian wheats. In 1902–3 Turkish Red again led in yield with 32.6 bushels per acre, while Weissenburg, another Hungarian variety, was best in quality. The Russian varieties proved hardier, but lodged severely and rusted much worse than the native and the Hungarian sorts. During the season of 1903–4 all the varieties except Weissenburg passed through the winter without injury, made a vigorous growth in the spring, and later lodged badly. This year Turkish Red stood first in productiveness and quality, the yield being 17.8 bushels per acre; Big Frame, ranking next in yield with 17.5 bushels, was very poor in quality.

A disease commonly called "scab" or "blight" attacked the wheat crop in 1903 and 1904 and caused a marked reduction in yield. The first of these years Turkish Red and the Hungarian varieties were unaffected, while Big Frame was severely attacked and several of the Russian sorts suffered considerable injury. In 1904 Turkish Red contained 15 per cent of scabby kernels, while in the other varieties the proportion of affected kernels ranged from 55 to 95 per cent.

The results in general indicate that the variety best adapted to Nebraska is Turkish Red, which not only gave the best yields, but also withstood attacks of disease better than any other variety grown. Kharkof and Beloglina, two of the new Russian varieties, proved hardier in the extreme northern part of the State, and hence are suggested for culture in that region. Several of the Hungarian varieties, although somewhat better in quality than Turkish Red, were late in maturing and in consequence proved less productive. Since their importation from Europe these varieties mature about a week earlier, and this is taken as an indication that by growing those wheats here for a longer period the objections—which are a medium yield, late maturity, and medium hardiness—may be overcome. For the present the work at the station and the results secured by farmers throughout the State indicate that the best success is to be expected from the selections of hardy strains of the well-known domestic Turkish Red. This variety is recommended as most desirable for all but the most northern counties of the State.

An investigation into the nature and causes of the appearance in hard winter wheat of yellow kernels, commonly known as "yellow berry," has been in progress for several years, and the results indicate, in general, that the number of yellow kernels increases with the ripeness of the grain and also with the length of time the grain in the sheaf is exposed to the weather. In 1903 a sheaf exposed from July 10 to August 21 contained 97.2 per cent of yellow kernels, while a bundle from the same plat cured in a moderately lighted and dry room

had only 25 per cent. The grain from the exposed bundle, very much discolored and badly bleached, represented an unmarketable grade. The grain from the protected sheaf was bright and of good, clear color. This test, repeated the following year, gave 7 per cent of yellow kernels for the protected bundle and only 16 per cent for the one left exposed, but the grain was as badly bleached and discolored as the year before.

The influence of the time of cutting on the amount of yellow berry was studied by cutting sheaves at intervals of four days from the time the kernel was in the soft dough stage until it had thoroughly ripened. It was shown that a steady increase in the amount of yellow kernels took place as the grain became riper. In 1904 an early cutting made July 7 had 7.6 per cent of yellow kernels and a cutting of overripe grain 19 per cent.

Since it has been shown that the amount of yellow berry increases as the ripeness of the grain increases and also with the length of time the cut grain is exposed to the weather, it is possible to lessen the loss by cutting the grain rather early and stacking as soon as sufficiently dry. This method of caring for the crop has the added advantage, if well done, of entirely preventing deterioration by bleaching and discoloring. By stacking the quality of the grain is kept up and the further advantage is obtained of having the field free from shocks, thus permitting early plowing.

A chemical study of the normal horny red and of the yellow kernels showed a higher nitrogen content in every sample of the normal kernels, thus indicating a larger quantity of gluten in the grain and consequently a greater value for milling purposes. In an anatomical study of the two kinds of kernels it was found that the number of large starch kernels was smaller in the horny red than in the yellow kernels, which also indicates a higher content of nitrogenous matter in the normal grain.

It is quite evident that the tendency toward the production of yellow berries through late harvesting or exposure is inversely proportional to the proteid content, and that consequently the soil and climatic conditions previous to harvesting also affect the quality of the grain in respect to the number of yellow berries. A soil rich in nitrogen and a hot, dry growing season are, other things being equal, less likely to produce yellow berries even under unfavorable conditions.

Tests of seed wheat from various sources in this country and from Hungary and Russia resulted in the best yields in every case from locally grown seed of the same variety. The experiments further showed that wheat undergoes changes when it is moved from one climate to another; that a variety brought from a more humid to a drier climate will not do as well for a number of years as the same variety grown in the dry climate continuously, and that wheat from a more humid region will make a ranker growth of straw, produce at first a larger and softer kernel, and give a smaller yield. It was also found that wheat from a drier region, as western Kansas, yields nearly

as well and produces a better quality of grain, but that it is very much more subject to scab or blight.

Wheat should yield better the longer it is grown in one locality. If it does not, if it shows signs of "running out," it simply means that proper care has not been taken. All wheat seed should be thoroughly fanned to free it from small, shriveled, light-weight kernels and all foreign seeds. Wheat for seed should not be allowed to get wet. It should never be stored in deep bins with the grain for market, where it is liable to become heated, but should be stored in dry, shallow, well-ventilated bins. If such care is taken, wheat in this region will not decrease in yield when grown in the same locality, provided proper crop rotations, methods of manuring, and tillage are followed to maintain the fertility of the soil.

The importance of good tillage in winter-wheat culture was shown by growing very poor seed wheat on well-tilled land, which resulted in a yield of several bushels more per acre than the average of the county or State for each of three successive years. The essentials in good tillage for wheat pointed out are rotation of crops, including seeding down to grass or alfalfa at intervals of four to eight years; application of barnyard manure to the soil for some previous crop, as grass, alfalfa, or corn, and early plowing, with immediate harrowing and drilling in the seed early in the fall, except when Hessian fly is to be avoided. The object of early plowing, together with immediate harrowing or disking, is to obtain a seed bed having the lower soil compacted and the surface in a well-tilled and loose condition.

An investigation of the variations in wheat from different regions and in different seasons indicated that the conditions influencing the percentage of nitrogen in the grain are apparently the natural tendency of the variety; the amount of readily available nitrogen in the soil, especially during the period of growth previous to heading, and the temperature and humidity, especially during the period of growth after heading. It was also shown that wheat stores up more nitrogen in the form of protein in dry seasons and more starch in wet seasons.

GLUTENOUS AND STARCHY WHEATS.[a]

In a previous bulletin of this series[b] attention was called to the importance of increasing the protein content of wheats, and the possibility of selecting seed with this end in view was indicated. In investigations which he has carried on for a number of years, H. Snyder, of the Minnesota Experiment Station, has found that wheat kernels grown from the same seed and on the same soil vary widely in size, color, weight, and composition, some samples containing as low as 8 per cent of protein, others as high as 20 per cent.

For purposes of nutrition, wheats with the maximum amount of protein or gluten, provided it is in the best form for bread-making purposes, are the most valuable; hence it is highly desirable to be able to distinguish wheats of high from those of

[a] Compiled from Minnesota Sta. Rpt. 1904, p. 179.

[b] U. S. Dept. Agr., Farmers' Bul. 237, p. 11.

low protein content by the appearance or general character. It was the aim in this investigation to study the characteristics of wheat kernels with the object of determining the physical conditions associated with high and low protein content. Because of the extensive use of wheat flour for food purposes it is unnecessary to suggest the importance of this matter when it is recalled that wheat of maximum gluten content contains as much protein as average beef, while that of minimum content contains no more than rice.

The fact that differences in composition are associated with differences in physical characteristics suggests that the latter may be used as the basis of a method of selection with reference to producing wheat of high protein or high starch content. Professor Snyder shows that "a physical examination of wheat kernels will often reveal their character as high or low in protein."

The fact that the light-colored seeds are more starchy in character, while the amber ones are more gluteneous, is valuable in the selection of seed wheat. In case it is desired to select seed which is glutenous, preference should be given to the medium-sized, heavy-weight, and dark-colored flinty kernels, as they contain a larger percentage of nitrogen than the lighter-colored kernels. The hand picking of glutenous kernels is possible in selecting seed for a small area. It is believed that such hand-selected seed would ultimately result in the production of wheat of high gluten content.

DRY FARMING.[a]

The production of crops without irrigation in regions having a limited rainfall is called arid or dry farming. As a rule, where dry farming is practiced the annual rainfall ranges from about 8 to 20 inches. There are vast semiarid areas in the West which can not be brought under irrigation, and this method of farming is an attempt to utilize some of these lands for other agricultural purposes than mere grazing.

Farming without irrigation was practiced in numerous localities by the early settlers, and while in many cases these efforts were successful, in many more they were failures. They demonstrated, however, that under certain conditions dry-land agriculture may be successfully practiced. The experience gained during the last thirty or forty years and the results of the recent work in this connection carried on by several experiment stations and other agencies, indicate that, by means of special methods of cultivation requiring, in some instances, special tools and implements, and by the use of drought-resistant crops and varieties, arid farming may be placed on a much safer basis than heretofore. The fact should not be disregarded, however, that under semiarid conditions without irrigation crop failures are bound to be much more frequent than in regions of adequate rainfall; and it is generally conceded that, in order to establish a permanent home on the dry lands of the western plains, provision should be made for the

[a] Compiled from Utah Sta. Buls. 75 and 91; Colorado Sta. Buls. 90 and 103. See also U. S. Dept. Agr. Yearbook, 1905, p. 423.

irrigation of a small area on which vegetable food for the family and forage for the stock kept may be grown with certainty every year to tide over the seasons of possible crop failures on the unirrigated portion of the farm.

The Utah Experiment Station points out that the two main problems in dry farming are (1) the absorption and retention of moisture by the soil, and (2) the culture of crops which make satisfactory growth and reach maturity with very little water. The soils of Utah, generally very deep and quite uniform to great depths in chemical and physical properties, are well adapted to dry farming on account of their great moisture-retaining capacity. The station estimates that under ordinary conditions the average annual rainfall of 12 inches can be held in 3¼ feet of soil of this description. In this method of farming, therefore, the soil should be treated to facilitate the absorption and retention of as much as possible of the moisture that falls upon it.

Data secured by the station indicate that on the dry farms of the State 750 pounds of water is required to produce 1 pound of dry matter in the plant, while experiments conducted in this country and in Europe show that under humid conditions only about 500 pounds is sufficient for the same purpose. A rainfall of 12 inches amounts to 1,361 tons of water per acre, or a quantity sufficient, if entirely used by the crop, to produce 27 bushels of grain, even on semiarid lands. Large areas within the State have an annual precipitation of 12 inches or more. During the summer months the proportion of sunny days reaches 80 per cent, and the average temperature from May to September is about 65° F. The highest average day temperature, which is from 100° to 105° F., occurs in June and July. Under these climatic conditions dry farming is considered feasible.

Utah recently established six experimental farms in different sections and placed them under the direction of the experiment station for further investigations on dry-farm practices. The first year's work on these farms was carried on in 1904. The land was plowed about 8 inches deep and brought to a fine tilth with disk and smoothing harrow. No summer fallow preceded these crops, and hence only one year's precipitation was used in their production. The rainfall records for the year show a precipitation of more than 10 inches on all the farms, and an average of 12.5 inches. The gravel in the soil on the different farms varied from 1.05 to 20.58 per cent, the sand from 50.96 to 75.52, the silt from 13.16 to 28.48, and the clay from 9.62 to 15.75.

The highest yield of winter wheat recorded at any of the farms was 23.83 bushels, and of macaroni spring wheat, 21.25 bushels. Of several varieties of oats, Sixty-Day gave the best general results, the yields ranging from 3.75 to 36.01 bushels per acre. The highest yields of barley and rye recorded are 34.9 and 14.04 bushels per acre, respec-

tively. Emmer was grown on two of the farms, and yielded 23.55 bushels on the one and 17.68 bushels per acre on the other.

The Colorado Station found that of spring wheat varieties Kubanka, a durum or macaroni wheat, appeared best adapted to the dry-land regions of that State, and that among the winter wheats Turkey Red gave the most satisfactory yields. The best yield of corn secured on the Utah experimental farms amounted to 25.93 bushels of ear corn and about a ton of stover per acre.

On all of these farms fall planting of alfalfa proved a failure, while spring planting produced a stand wherever tried. To obtain a good stand of alfalfa under similar conditions, the Colorado Station recommends plowing the ground early in the season 5 to 8 inches deep, harrowing it until it is well packed, and planting the seed after the ground is thoroughly wet. If a crust has been formed on the surface by the rain, this should be broken up with a light harrowing and the seed then sown broadcast. If a drill is used, the seed should be drilled in as soon as the ground shows dry on top. The sowing may be done at any time, while the ground is in good condition, between May 10 and July 15.

A study of the principles of dry farming made by the Utah Experiment Station indicates that fall plowing is essential for the purpose of opening the soil and permitting the storage of the fall and winter precipitation, and that deep plowing and, in many cases, subsoiling is desirable, as the water is stored deeper and is not so readily driven off by the direct rays of the sun. In general wheat was the most successful crop grown. On account of the limited quantity of soil moisture thin seeding is recommended, as it was found that sowing from one-half to 1 bushel of wheat per acre gave the best results. Fall sowing is preferred to spring sowing, as the crop beginning its growth in the fall is at a better advantage to make use of the soil moisture. Experience has shown that sowing broadcast when the surface is dry does not place the seed deep enough in the soil to assure favorable conditions for germination, but that by the use of the press drill this difficulty is largely overcome. Dry farming does not generally produce long straw, and the harvesting for this reason is done with the header.

The main purpose of summer fallow on dry farms is to store the water of two or more seasons in the soil for the production of a crop, and hence this is practiced more frequently where the rainfall is limited than where it is heavier. The Colorado Station gives the following directions for this practice:

After the snows of winter have melted in the spring plow the ground at least 7 to 8 inches deep. Level this down with the harrow and packer, following this process with a smoothing harrow forming an earth mulch to check evaporation. This mulch should not be too fine, as the winds of the plains will tend to rift the soil or blow the

earth mulch entirely away. If possible, stir the surface soil from 2 to 4 inches every 10 to 15 days throughout the summer. Allow no crust to form after summer showers, as this will increase the evaporation of the soil moisture. Keep the ground clean, free from weeds.

In addition to the crops grown in the tests noted above, Kafir corn, sorghum, millet, field peas, brome grass, meadow fescue, and western wheat grass have given good results on the plains. As regards the quantity of water required for maturity the common field crops are placed in the following (ascending) order by the Colorado Station: Corn, potatoes, wheat, barley, field peas, oats, alfalfa, and red clover.

IMPROVED METHOD OF CANNING.[a]

In a recent farmer's bulletin of this Department[b] relating to canning and preserving it was explained that in practice canned fruits and vegetables are heated to a boiling temperature, or above, for some time, in order to kill the yeasts, molds, etc., which readily grow on these materials under favorable conditions, resulting in spoiled goods. In heating many fruits and vegetables to this high temperature they lose their shape and become mushy in appearance, especially when shipped long distances, and there is more or less loss of flavor and quality.

E. F. Pernot, of the Oregon Experiment Station, has been studying methods of canning and has described a method by which practically all fruits and many vegetables can be successfully canned by intermittent pasteurization at a much lower temperature. By this method clean fruit and vegetables are placed in clean cans, and water that has been boiled to sterilize it is added to fill the interstices. The cap is then placed on the can and soldered, leaving the vent open. The cans are then placed in a wooden steam chest and kept there until the temperature registers 165° F. in the center of the cans. This temperature is then maintained for fifteen minutes, after which the cans are allowed to stand for twenty-four to forty-eight hours, when they are again heated as before. This operation is repeated for the third time. The contents of the cans are then sterile and will keep perfectly.

The principle involved in this method of canning is that the active vegetative cells of yeasts and molds, which cause fermentation, are killed by heating up to a temperature of 165° F. The spores of these plants, however, are not killed at this temperature, but by waiting twenty-four to forty-eight hours they nearly all germinate; the second heating kills all the spores that have thus germinated. Should any still remain, they germinate during the next twenty-four to forty-eight hours and are killed by the third heating.

Fruits and vegetables thus sterilized in the cans remain practically

[a] Compiled from Oregon Sta. Bul. 87.

[b] U. S. Dept. Agr., Farmers' Bul. 203.

in their natural condition and represent the highest grade of canned goods. It is stated that fruits containing pits should not be preserved in this manner without first removing the pits, as there is danger of the pits germinating when kept in a warm atmosphere. This method involves considerably more labor than by the usual method of heating once up to the boiling point, but, on the other hand, preserves the fruit in a much more attractive condition and gives a higher quality of product.

Corn and peas can not be canned by this method, but all of the fruits and such vegetables as tomatoes, green beans, wax beans, cauliflower, and asparagus have been canned by this method and kept perfectly, retaining their natural color, flavor, and texture. The beans, when taken from the can, could be broken in the same manner as when fresh. These beans, after being preserved one year, were found to be of the finest quality.

Extensive investigations were made by Mr. Pernot on the micro-organisms causing fermentation and ptomaines in canned fruits.

All canneries sustain a loss of a percentage of their goods through one cause or another, either from insufficient heating, or more frequently from defective cans which are not air-tight. When the can is cooling there is a partial vacuum formed, which draws air into it through the leak and inoculates the material with organisms; putrefaction or fermentation at once begins, and after a time the cans show evidence of decomposition by the liquids oozing out or by swelling. The latter also occurs when insufficient heat is used to destroy the spores of organisms previously contained in the material.

By the time the germs have produced enough gas to swell the can, and if they are of certain varieties, sufficient toxic poisons will be produced to render the material dangerous for food.

In some canneries when cans are noticed to have swelled they are punctured to allow the gas to escape, then exhausted, sealed, and reheated. The contents of cans which have swelled should be thrown away and not offered for sale as food.

BEET MOLASSES AND BEET PULP FOR FARM ANIMALS.[a]

After the juice is expressed from sugar beets the pulp is dried with or without the addition of beet molasses and sold to some extent as a feeding stuff. The sugar-beet molasses is also used as a feeding stuff, being mixed on the farm with other feeding stuffs which absorb it to a greater or less extent and make it convenient to handle.

The process of preparing these products and the advantages of drying the pulp are thus briefly described in a bulletin of the New Jersey Stations:

Dried beet pulp is comparatively a new article on the market, and is the dried residue in beet-sugar manufacture. It comes from the sugar factory, through an operation, briefly, as follows: The beets are washed, then shredded into small round

[a] Compiled from Massachusetts Sta. Bul. 99; Michigan Sta. Bul. 220; New Jersey Stas. Rpt. 1904, p. 366, Bul. 189; Utah Sta. Bul. 90.

strips and placed in large upright cylinders, through which hot water is forced, dissolving out the sugar. This liquor is drawn off and the pulp, containing about 92 per cent of moisture and 1 per cent of sugar, is conveyed to large presses, which reduce the moisture to 82 per cent. It is then put into large kilns and thoroughly dried by direct heat. The drying process lasts about thirty-five minutes, and the resulting product is sacked and ready for shipment. After extracting the sugar from the liquor which has been drawn off, there is a residuum of molasses, containing about 50 per cent of sugar, and a certain amount of this product is mixed with the fresh pulp, then dried, and sold under the name of dried molasses beet pulp. The advantages of drying are: (1) It can be kept for an indefinite time without affecting its feeding value; fresh pulp will ferment and sour and, therefore, can be used only in the immediate neighborhood of the factory; (2) ease of shipment, one ton of dried pulp being equivalent to from 12 to 14 tons of fresh pulp; (3) by soaking the dried pulp with water just before feeding, it gives all the advantages of a succulent feed. It was believed that dried beet pulp, soaked, might, in the absence of other succulent foods, serve as a substitute for silage, hence an experiment was planned to study this point.

G. A. Billings, of the New Jersey Stations, has made a series of experiments to test dried beet pulp as a substitute for corn silage and to compare dried beet pulp and molasses with dried pulp and with hominy meal as feeds for dairy cows. The relative value of the different feeds was measured by their effect upon yield of milk and butter, quality of milk, relative cost of milk and butter, and effect on the gains or losses in weight of the individual cows.

The composition of the feeds used was as follows:

Composition of feeds.

Constituent.	Dried pulp.	Dried pulp and molasses.	Silage.	Hominy meal.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Water	8.20	7.57	71.98	7.16
Protein	8.56	9.68	1.73	10.44
Fat	.59	.42	1.04	8.41
Nitrogen-free extract	....	59.79	16.13	69.50
Crude fiber	17.13	15.65	7.26	1.67
Ash	....	6.94	1.91	2.82

The daily rations used were as follows: (1) Dried beet pulp 9 pounds, mixed hay 10, feed mixture 10½; (2) corn silage 45, mixed hay 5, feed mixture 10½; (3) mixed hay 13½, plain dried beet pulp 8, feed mixture 7; (4) mixed hay 13½, molasses beet pulp 8, feed mixture 7; (5) mixed hay 13, hominy meal 7, feed mixture 7 pounds.

The feed mixture used in the first two rations consisted of 300 pounds dried brewers' grains, 300 pounds buckwheat middlings, and 100 pounds cotton-seed meal; in the last three of 200 pounds buckwheat bran, 300 pounds dried brewers' grains, and 100 pounds old-process linseed meal.

The beet-pulp products used in these experiments were valued at $20 per ton, the silage $4, and the hominy meal at $23.

The dried beet-pulp ration produced 10.2 per cent more milk and 9.7 per cent more butter than the silage ration, or 11 pounds more

milk and 0.5 pound more butter per 100 pounds of digestible nutrients consumed. The silage ration produced milk at 2.8 cents less per 100 pounds than the beet-pulp ration, or a net gain of 3.31 per cent over the beet-pulp ration. It produced butter at 0.61 cent less per pound than the beet-pulp ration, or a net gain of 3.48 per cent over the latter. The net gain in flesh per animal was 24.5 pounds greater with the silage ration than with the beet-pulp ration.

The dried beet pulp and molasses ration produced 0.96 per cent more milk and 1.4 per cent more butter than the plain dried pulp, but the dried pulp ration produced milk at 2.6 cents less per pound than the molasses-pulp ration, showing a net gain of 3.9 per cent over the latter, the quality of the milk being very nearly the same in both cases. It produced butter at 0.7 cent less per pound than the molasses-pulp ration, showing a net gain of 4.7 cents over the latter. The average net gain in weight per animal was 14 pounds greater with the plain pulp ration than with the molasses-pulp ration.

The dried beet pulp and molasses ration produced 4.07 per cent more milk at 4.7 cents less per hundred pounds and 6 per cent more butter at 1.2 cents less per pound than the hominy ration. There was a net gain of 6.02 per cent in case of milk and 6.3 per cent in case of butter in favor of the molasses-pulp ration. The milk also contained 0.04 per cent more fat with this ration than with the hominy ration. There was very little difference in the gain in weight of the animals on the two rations.

At the Utah Experiment Station L. A. Merrill and R. W. Clark studied the feeding value of beet molasses and beet pulp with six lots of 2 steers each and six lots of 16 sheep each, the steers and sheep receiving rations of the same character. One lot of each class of animals was fed alfalfa hay and all the sugar-beet pulp they would eat. The other lots were fed alfalfa hay with bran and shorts, the amounts varying in different cases, one lot of each class of animals receiving 8 pounds of molasses per day and the others as much sugar-beet pulp as they would eat. In the one hundred and seven days covered by the test the steers fed the molasses ration made an average daily gain of 1.85 pounds per head. On the other rations the greatest gain, 2.26 pounds per head, was made by the lot fed alfalfa hay and bran and shorts with beet pulp, and the smallest gain, 1.48 pounds per head, on alfalfa hay and beet pulp. The calculated net profit per lot on the molasses ration was $5.51, and on the other rations it ranged from $4.33 on alfalfa hay, bran, and shorts to $11.56 on alfalfa hay with beet pulp.

In the test with sheep the average daily gain per head on molasses was 0.15 pound and the net profit per lot $4.85. On the other rations the gain ranged from 0.073 pound on alfalfa hay and beet pulp to 0.2 pound on alfalfa hay and bran and shorts with beet pulp. The profit

per lot ranged from $3.78 on alfalfa hay and bran and shorts to $10.81 on alfalfa hay with a small amount of bran and shorts and beet pulp.

The authors note that, when slaughtered, the steers fed all the beet pulp they would eat with alfalfa hay and bran and shorts produced the best quality of meat. The loin was heaviest and the flesh fairly well marbled, firm, and juicy. The sheep fed the largest quantity of grain gave the best carcasses, but with them the profit was less than with those receiving little or no grain. Some of the authors' conclusions follow:

Molasses fed to steers had a value of $2.35 per ton. As a sheep food it did not give the results expected. Beet pulp when fed to steers with grain and alfalfa had a value of from $1.66 to $2.54 per ton, and when fed to sheep its value ranged from $1.08 to $3.66 per ton. Steers that received grain made larger and cheaper gains and required less dry matter per pound of gain the latter part of the feeding period than the forepart. Steers which received only alfalfa and pulp made practically as good gains the forepart of the feeding period as the latter part.

At the Michigan Experiment Station R. S. Shaw studied the feeding value of beet pulp dried with and without the addition of molasses with five lots of 18 lambs each, the experimental period covering eighty-five days. One lot was fed the molasses beet pulp with grain and one lot grain only. The remaining lots were fed beet pulp with different proportions of grain, and all the lots were supplied with clover hay. On the molasses beet-pulp ration the average daily gain per head was 0.343 pound. The gain made on the beet-pulp rations without molasses varied somewhat, being on an average 0.336 pound. On the ration containing no beet pulp it was 0.330 pound. The cost of a pound of gain on molasses beet pulp was 4.15 cents, and on beet pulp and grain 3.84 to 4.18 cents, and on grain without beet pulp 4.88 cents.

As regards palatability, the author's observations led him to conclude that sheep generally prefer the dried molasses beet pulp to the dried beet pulp.

The lambs were sheared before slaughtering, the fleece of those fed the molasses beet pulp ration weighing on an average 6.51 pounds and ranging with the other lots from 6.08 pounds on the ration without beet pulp to 7.11 pounds on the ration containing dried beet pulp with linseed meal. The dressed weight of the lots was about 52 per cent of the live weight in every case, the differences observed in the several lots being small. Considering the tests as a whole the calculated profit was $1.18 per head on an average.

Some earlier tests in which beet pulp was fed are also reported, and from the investigations as a whole the following conclusions were drawn:

These tests seem to indicate that both dried beet pulp and dried molasses beet pulp are possessed of feeding values comparing very favorably with corn. Grain mixtures containing dried beet pulp produce more mutton at less cost than similar amounts of

grain mixtures alone. Dried molasses beet pulp possesses a somewhat higher feeding value than dried beet pulp, but in this experiment the difference was not great enough to offset the difference in price.

At the Massachusetts Experiment Station J. B. Lindsey studied the feeding value of molasses beet pulp as compared with corn meal in a test with milch cows which covered twelve weeks. The average milk yield per cow on the molasses beet-pulp ration was 27.7 pounds and on the corn-meal ration 29.1 pounds. On the molasses ration the total solids were 155.9 pounds and the total milk fat 54.1 pounds, and on the corn-meal ration these values were 162.6 and 56 pounds.

From the recorded data the author calculated that 3 to 6 per cent more digestible material and dry matter was required to make milk and milk ingredients with the molasses beet-pulp ration than with the corn-meal ration. Doctor Lindsey notes that successful results were not obtained when attempts were made to feed molasses beet pulp to pigs, the animals uniformly refusing it.

The digestibility of the molasses beet pulp was studied with sheep and found to be on an average as follows: Dry matter, 85 per cent; protien, 64 per cent; nitrogen-free extract, 91 per cent; and crude fiber, 84 per cent.

Among the conclusions which were drawn regarding molasses beet pulp are the following:

It keeps well, will absorb large quantities of added water, has a slightly laxative effect, has proved a palatable and healthful food for dairy stock, and satisfactory as a component of a grain ration for the production of milk. It can also probably be used with good results for fattening and as a partial grain feed for horses. Because of its coarse mechanical condition, it will serve as a diluter for the heavier concentrates. It is rather inferior in nutritive effect to corn meal (probably 10 per cent).

The results of experiments on the feeding value of molasses and of beet pulp have been summarized in earlier Farmers' Bulletins of the Department.[a]

MUDDY VERSUS DRY FEED LOTS.[b]

Muddy feed lots are an unprofitable as well as disagreeable feature in cattle feeding, especially when no provision is made for shelter. In a summary of replies to a circular of inquiry regarding the methods followed by practical feeders, compiled by H. W. Mumford and L. D. Hall, of the Illinois Experiment Station, the question of muddy feed lots was considered. Notwithstanding the fact that the disadvantages of mud and dirt were recognized, only 36 of the 500 and more cattle feeders who furnished information on this point reported definite provisions against such conditions. Of these, 10 have the surface of feed lots paved or otherwise artificially covered; 15 use rock, gravel,

[a] U. S. Dept. Agr., Farmers' Buls. 22, 107, 162, 170.

[b] Compiled from Illinois Sta. Circ. 98.

cinders, bricks, planks, corncobs, or sawdust, alone and in combination in various parts of the lot; for instance, about the feed troughs, water tanks, sheds, or gates. Ten of the correspondents state that they have made the lots dry enough for feeding purposes by a tile drain, while 2 report that the yards have been graded and the mud and manure removed by means of dirt scrapers. Several of those who use coal cinders for filling the muddy portion of the lot state that care must be taken to keep them covered with straw, cornstalks, or other bedding material in order to avoid injury to the feet.

FIG. 1.—Brick-paved feed lot, with convenient shelter, water, and feeding arrangements.

Figure 1 shows a brick-paved feed lot, with convenient shelter, water, and feeding arrangements, designed to accommodate about 50 cattle, which has given satisfaction. The pavement is 24 by 80 feet and is made of brick laid flat on 6 inches of gravel packed until solid. The curbing consists of curbstones 18 inches wide and 3 inches thick set edgewise. Feed bunks were placed in the shed, as shown in figure 1. Adjoining this paved lot is a yard containing about one-half acre in which the hayrack is located. The shelter consists of a building 20 by 26 feet, with two wings each 20 by 30 feet. The upper floor of the middle portion is used for storing dry corn fodder, which can be conveniently cut and fed through an open shaft to the feeding bunks below.

Figure 2 shows a feed bunk with platforms for use in muddy lots, which is inexpensive and has proved satisfactory. The platforms in the sample described were 16 feet by 6 feet and were made of 2-inch

bridge plank cut 6 feet long, laid on five white-oak 2-inch by 4-inch timbers 16 feet long. The feed bunks were made in the usual way, 2 feet 6 inches high, 3 feet wide, and 16 feet long.

There are three advantages in the floors. The feeder always has a dry place to walk when putting in feed; the cattle are out of the mud and not in a strained or cramped position while feeding; by having the floors 6 feet wide all wasted feed and droppings fall upon the floor and the hogs get all before it is lost in the mud.

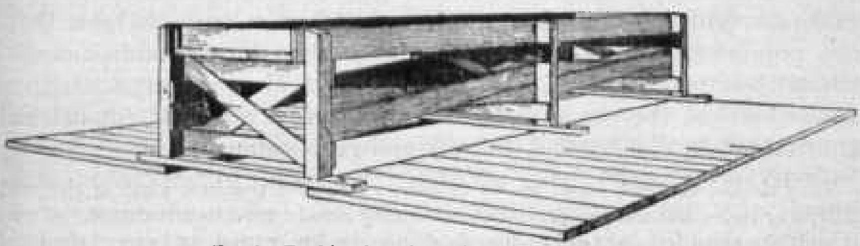

Fig. 2.—Feed bunk with platforms, for muddy lots.

The platforms for the water tanks described were very similar in construction.

REARING AND MARKETING GUINEA FOWLS.[a]

The Connecticut Storrs Station has made an extended study of the chemical composition of poultry and poultry products, including guinea fowls and some game birds, as well as the more common kinds of domestic poultry.

With respect to guinea fowl, the analyses show that the flesh more closely resembles chicken and turkey in composition than it does dark-fleshed birds like ducks and geese, which are on an average richer in fat. Judged by chemical composition, the guinea fowl, like other poultry, is a valuable and nutritious article of diet and is commonly conceded to be very palatable, resembling game quite closely.

On the basis of experience, a southern poultry raiser[b] considers that it is best to raise guinea chicks with a common hen or turkey as a mother, particularly since they can be kept out of wet grass and weeds in the early morning more readily than when hatched by guinea hens. In the experience of this writer attacks of mites and lice more often end fatally with guinea fowls than with other poultry, and whitewashing the trunks and branches of the trees where they roost is recommended. This writer also believes that after laying, sitting, and molting the guinea hens should be caught and dipped in water and grease to free them from vermin.

Another poultry raiser[c] on the basis of personal experience recommends for newly hatched guineas a coop 8 or 10 feet long, 5 feet wide,

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[a] Compiled from Connecticut Storrs Sta. Buls. 27 and 38, Rpt. 1903, p. 147; Jour. Bd. Agr. [London], 12 (1905), p. 533.

[b] Texas Farm and Ranch, 25 (1906), No. 5, p. 14.

[c] Texas Farm and Ranch, 25 (1906), No. 9, p. 14.

and about 2 feet high, covered on the sides with 1-inch mesh wire netting and on the top with 2-inch mesh netting. This coop, which can be easily moved from place to place, has a door in one end, and in bad weather can be covered on top with boards. If fed in the coop and fastened in so that they will roost there, the chicks will readily learn to return to the coop at night.

H. de Courcy, in an article on the guinea fowl for British poultry raisers, recently published by the Board of Agriculture of Great Britain, points out the value of this class of poultry for the table and discusses their feeding, care, and management. He suggests that when newly hatched the chicks may be fed on any one of the commercial chicken meals, moistened with milk and raw beaten egg.

They should also get green food from the start, and the best kind is chopped onions or leeks, but lettuce, dandelion, etc., may also be used to advantage. When the chicks are a few days old plainer foods may be freely used, and one of the most wholesome is coarse oatmeal fed dry. This may be varied by the occasional use of boiled rice, raw rice meal, hemp seed, millet seed, etc. At a later stage—say when three or four weeks old—some middlings and fine barley meal may be added to the mash. Grit of fine quality must be regularly supplied from the time the chicks leave the shell.

There is nothing so wholesome for the chicks as insect food. Dried ants and ants' eggs are often used [in Great Britain] by those who rear pheasants and guinea fowls, but in many districts, especially where the soil is sandy, there are ant-hills in the fields. In such farms it is only necessary to place the coop in which they are kept near an ant-hill and the chicks will feed greedily on the insects and their eggs. * * *

When a few weeks old the chicks should be given a free run with the old hen, and the best kind of range for them is an overgrown, weed-covered garden, orchard, or shrubbery. In such a place they can find as much insect food as they need to keep them in health; but if the run is small, or if too many birds are kept on it, it becomes necessary to feed guinea chicks with a small quantity of meat in their mash. One of the prepared meat foods or finely chopped fresh meat and fresh bone may be used.

In a recent bulletin of the Connecticut Storrs Station the marketing of poultry and poultry products is discussed by F. H. Stoneburn:

Of late there has developed quite a demand, particularly in New York, for young guinea fowls for broiling. There is a small but steady demand for adult birds also. Most of this stock is sent to market with all feathers left on, the killing being done by sticking in the same manner as with other poultry.

Sticking the bird in the mouth and throat with a sharp, narrow-bladed knife is certainly the best method of killing [poultry] for the American market. (A great deal of the poultry designed for the English market is killed by dislocating the neck.) * * * The necessary "tools" are a knife with a long narrow blade, a short heavy club, and some receptacles to catch the blood.

A recent bulletin[a] of the Department of Agriculture summarizes available data on the breeding, care, and management of guinea fowls, the value of the flesh and eggs for table purposes, and related questions.

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[a] U. S. Dept. Agr., Farmers' Bul. 234.

COLOR OF EGGS.[a]

COLOR OF SHELLS.

It is a matter of common observation that hens' eggs vary rather widely in color, ranging from a clear white to a decided light brown. Domestic poultry have descended from several wild strains, the various breeds being formed by numerous crossings. The color of the eggshell, it is generally believed, is a characteristic which has been transmitted from the early ancestors of our modern breeds.

There is no constant relation between the color of the shell and the composition of the egg, although there is a popular belief in some localities that the dark-shelled eggs are "richer." That there are no differences in the physical properties and chemical composition between brown-shelled and white-shelled eggs was shown by investigations carried on at the California and the Michigan experiment stations, this work having been summarized in earlier publications of this Department.[b]

The color of the shell has, however, an effect upon market value, the brown-shelled eggs bringing the higher price, for instance, in the Boston market, and white-shelled eggs in the New York market. In England the preference is decidedly in favor of the tinted eggs.

Of common breeds, Plymouth Rocks, Wyandottes, Cochins, Brahmas, and Langshans, among others, lay brown-shelled eggs, and Leghorns and Minorcas white-shelled eggs.

At the Maine Experiment Station breeding experiments with Wyandottes and Plymouth Rocks have been carried on for a number of years for the purpose of establishing strains with highly developed laying qualities. The recorded data show that though both breeds lay tinted eggs the depth of color varies decidedly with individual birds in the case of each breed. By careful selection of breeding stock, therefore, it should be possible to control the color of the eggshell to a great extent, so that it may be made to meet any market demand.

In this connection it is interesting to consider the ancestry of the Plymouth Rocks and Wyandottes. The Plymouth Rocks are said to have originated from American Dominiques and Black Javas, with light and dark Brahma and Pitt Game blood also. All these varieties lay tinted or brown eggs, so it is natural to expect that this would be a characteristic of the different strains of Plymouth Rocks.

The Wyandottes of different sorts are a comparatively new breed, said to have originated about twenty-five years ago from crosses of

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[a] Compiled from Maine Sta. Buls. 79, 93, 117; New York State Sta. Bul. 171; Jour. Bd. Agr. [London], 12 (1906), No. 10, p. 611; The Feeding of Animals, by W. H. Jordan, 1901, p. 382.

[b] U. S. Dept. Agr., Farmers' Buls. 87, 128.

dark Brahmas, Silver Spangled Hamburgs, and the French Breda fowl, with possibly Cochin blood also. The Spangled Hamburg and the Breda lay white-shelled eggs and the Brahmas and Cochins brown-shelled eggs; so it is evident that from these last-mentioned breeds the Wyandottes inherit the trait of producing tinted eggs.

The Board of Agriculture of Great Britain recently published the following statements regarding brown-shelled or tinted eggs:

The breeds which produce tinted eggs are, without exception, sitters; and of the breeds which are commonly kept the following list includes those which yield eggs of the desired character: Langshans, Cochins, Plymouth Rocks, Orpingtons, Game, Wyandottes, Brahmas, Faverolles, Coucous de Malines. In addition, there are other breeds which are not kept for egg production, notably the Indian Game and the Malay. Of the varieties named the Langshan produces the most beautifully tinted egg, and this perhaps explains why that variety at one time attained such popularity.

Unfortunately, some of the breeds mentioned lay eggs which are small in size, but in this connection it must be borne in mind that small eggs may be more acceptable to the consumer if tinted than are larger white eggs. Crosses are frequently made with a view of increasing the prolificacy, and at the same time securing larger size generally. This results in the shells being less highly tinted than would otherwise be the case.

In crossing two breeds producing, respectively, white and tinted eggs, it is necessary to depend chiefly upon the females for conservation of the tinted characteristic, and it is advisable that in such crossing the male only should be selected from the white egg-producing races.

A number of crosses are recommended for the production of tinted shells, among them being White Leghorn with Langshans and with Buff Orpington, Brown Leghorn with Buff Orpington, and Minorcas with Langshans and with Buff Orpington.

A White Leghorn-Plymouth Rock cross is of great value, as both the parents are very hardy and active; and, although the color of the eggs produced may not be so deep as in some of the crosses already named, yet it is sufficiently so to meet the market demands.

In the case of a Minorca-Wyandotte or a White Leghorn-Wyandotte cross, the object is to insure a larger size in the egg, because the Wyandotte, although a prolific layer, produces eggs which are distinctly small, and in crossing it is desirable to remedy this weakness. The cross between the Minorca and the Wyandotte would insure a much larger egg.

One great advantage which all breeds producing tinted eggs possess is that they are in general better winter layers than the varieties producing white-shelled eggs, this being perhaps due to the fact that they are usually very good sitters and mothers, and so obtain a rest during the spring and summer months.

COLOR OF CONTENTS.

That the flavor of eggs is greatly influenced by feed is generally recognized and has been proved experimentally at the North Carolina Experiment Station[a] in a test in which wild onion tops and bulbs were

[a] U. S. Dept. Agr., Farmers' Bul. 122, p. 25.

added to the ration. As is well known, the flavor is also affected to a considerable extent by the care and handling of the eggs. The effect of feed on the color of the yolk and white is a matter which is doubtless less commonly considered by poultry raisers than the effect of feed on flavor, yet it is known that there is a relation between them. Though frequently the yolk is pale, the color which we associate with the egg yolk is a decided yellow. The yellow coloring matter has been studied in the laboratory and is related to the coloring matter, also of animal origin, called lutein. The pale-yolked eggs are commonly considered inferior by housekeepers, as a given number impart to cake or custard less of the yellow color, which is looked upon as an indication of richness, than would eggs with a darker yolk.

The cause of pale yolks is not known with certainty, but as has been pointed out by W. P. Wheeler, of the New York State Experiment Station, the eggs laid by hens fed only certain grains and animal feeds generally have this characteristic, and adding to the ration a liberal amount of fresh or dried young clover, alfalfa, or grass will, as a rule, insure the deeper yellow color which is desired.[a] The effect of green feed on the color of the yolks is illustrated by a test at the New York State Experiment Station in which four lots of hens were fed alike except that no hay or green feed was given to one lot, while the other three lots had different amounts of clover hay alternating with green alfalfa. The depth of color of the yolk varied in the different lots and was directly proportional to the amount of clover and alfalfa fed.

It is perhaps possible that the coloring bodies or other materials containing iron, present in the green feed, have an effect upon the yellow coloring matter of egg yolk, but whatever the reason it seems from the New York work cited that the poultry raiser who desires eggs with deeply colored yolks can obtain them by feeding an abundance of such green materials as those indicated.

The egg white also varies somewhat in shade, having a more or less pronounced greenish cast before cooking and corresponding variations when cooked. That the color of the egg white varies more or less with different rations was noted in the New York experiments cited, but there was little uniformity in this respect. There is a belief that the cooked whites of eggs with shells of like tint will match in color and that the albumen of white-shelled eggs is decidedly whiter when cooked than that of eggs with tinted shells. Perhaps few of us carry our preferences so far that we will refuse an egg on account of the color of the white, yet it is stated on good authority that in first-class hotels and restaurants, where great attention is paid to details, it has been found that the boiled eggs served must match in color. If when taken from the shell one is greenish white and the other clear white,

[a] U. S. Dept. Agr., Farmers' Bul. 186, p. 27.

the eggs are often objected to on the ground that one of them is not of the required standard of excellence.

A large number of analyses of eggs have been reported, but no differences have been noted in composition which correspond to variations in color, though it is not unlikely that there are some differences in flavor and that the deep yellow yolks have a more pronounced flavor than the pale yolks. At any rate, as long as preferences for deep-colored yolks and clear whites exist the poultry raiser who caters to a fancy market should take them into account.

When eggs are boiled it is often noted that the yolk where it joins the white shows a more or less pronounced greenish color. This is due to dark-colored compounds of sulphur and iron produced during the boiling.

Silver is very quickly turned dark by air containing sulphur fumes. The blackening of silver forks and spoons, so commonly noted when they come in contact with eggs at table, is due to the action upon the silver of the small amount of hydrogen sulphid or other sulphur body liberated from the egg white when it is cooked.

The food value of eggs and their place in the diet has been discussed in a farmers' bulletin of this Department.[a]

SPRAYING FOR SCALE INSECTS IN THE FALL.[b]

On account of the unfavorable results which were obtained by many entomologists and fruit growers in applying insecticides for scale insects during the fall or early winter, this operation has generally been postponed until late winter or early spring, just before the buds swell. The reasons commonly given for this practice included not only the experience which many had had in injuring the trees by early applications, but the belief that the insecticide would remain longer on the tree if applied in early spring. In the case of the lime-sulphur wash it is obviously an advantage to have the insecticide upon the tree in a satisfactory condition at the time when the young scales are moving about.

According to experiments by J. B. Smith, entomologist of the New Jersey Station, it appears that all kinds of insecticides effective against scales may be applied with success in the early fall, even before the trees have become thoroughly mature. In his experiments Doctor Smith used various preparations of soluble petroleum, lime and sulphur, whale-oil soap, kerosene limoid, and other preparations. The ordinary scale insects can not be kept in check in summer for the reason that the foliage is injured when a sufficiently strong solution of a contact insecticide is used. If, however, applications are made in the

[a] U. S. Dept. Agr., Farmers' Bul. 128.

[b] Compiled from New Jersey Sta. Bul. 186.

fall, after a part of the leaves have fallen off, or as soon as the leaves have turned yellow and the tree gives evidence of being nearly mature, a considerable percentage of the scale insects will still be active, and will be immediately destroyed by the insecticide. The application of ordinary treatments such as those just mentioned appears not to produce material injury to fruit trees, even including peach. For the latitude of New Jersey, Doctor Smith sets October 15 as about the right date to begin the fall application of scale insecticides in average years. The purpose sought in applying the insecticide as early as possible is to catch the scale insects in an active condition while they are therefore exposed to the action of the remedy. As long as the sap circulates in the tree some of the scales are active, and since the trees appear not to be injured when treated after October 15 this seems to be a very good season for making the application. A few of the leaves are injured by early fall applications, and, in general, the foliage may drop off somewhat sooner than it otherwise would. This appears not to be of any moment, however, since the trees come out in spring in a thrifty condition and show no bad effects of the application.

PLANTING WHITE PINE IN NEW ENGLAND.[a]

L. R. Jones, of the Vermont Station, has been making a series of observations and experiments in forest planting, supplementing the work of New Hampshire foresters and of the Forest Service of the United States Department of Agriculture, which lead him to conclude "that Vermont, in common with other parts of New England, is naturally adapted to the growth of white pine and that pine is the easiest and most profitable tree for forest planting under most conditions."

> In many cases all that is needed is to encourage and direct the natural processes of reforestation. * * * It has been estimated that under typical New England conditions a white pine forest can be planted and kept for forty years at a total cost of about $51. It should then be worth $160. * * *
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> Making all allowances, the conclusion seems justified that few more profitable long-time investments are open to the Vermont public to-day than the planting of white pine on the low-priced lands which abound in the State. And the man who does it may have the further expectation that such an investment will not only enrich his heirs far more than any form of life insurance, but will in addition contribute to the prosperity and attractiveness of the entire community. Of course it is a matter of good judgment—common sense—that one should not go into such a thing rashly. Certain details as to the management of the nursery, the setting of the trees, and local soil adaptations, can only be learned by experience. When one has not this he may well begin on a small scale or secure expert advice and planting plans from the National Forest Service.

According to Professor Jones, the natural processes of reforestation can best be promoted by the transplanting of native or nursery-grown seedlings, the latter, either home-grown or purchased, being preferable.

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[a] Compiled from New Hampshire Sta. Buls. 95, 106, 119; Vermont Sta. Bul. 120.

Practical directions for collecting the seeds, starting a nursery, transplanting, and subsequent care are given by Professor Jones.

F. W. Rane, of the New Hampshire Station, "after years of experience in purchasing and transplanting white pine seedlings from nurserymen, and endeavoring to make the restocking of lands to forests a simple and economic problem * * * in New England," believes the key to the situation lies in the utilization of the native seedlings. By making use of the wild pine seedlings, which undoubtedly grow on most farms, "a beginning can be made in practical forestry, the benefits of which can be little realized at present. * * * Experiments show that the wild seedlings can be dug for 75 cents a thousand where moderately thick and transplanted at varying prices, according to the nature of the soil, from 75 cents upward," and it is believed to be good economy to utilize such seedlings before purchasing nursery-grown stock.

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